Environemental perils of climate change in India:Future concerns and strategies

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Abstract

Climate change is a global environmental problem which has been receiving intense political attention both at domestic and international levels. The United Nations Framework Convention on Climate Change (UNFCCC) defines 'climate change' as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. India is committed to the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which represent the international consensus on the way to deal with climate change. India believes that uncompensated climate change mitigation by developing countries may hamper the speed of their economic growth. India has a very comprehensive framework of legal and institutional mechanisms in the region to respond to the tremendous challenges to the environment it is facing, owing to population growth, poverty and illiteracy augmented by urbanization and industrial development. Climate change is inextricably linked to the broader sustainable development agenda to reduce poverty, child mortality and morbidity, and to ensure universal primary education for all children. Hence climate change is threatening the capacity of the country like India to attain the Millennium development goals by 2015. The study is mainly based on secondary data. The various sources include human development reports, UNDP reports, ADB reports, published and unpublished documents including journals, books, occasional publications, working papers, popular magazine and annual publications of social development organizations. India has initiated several climate-friendly measures, particularly in the area of renewable energy. India had adopted the National Environment Policy 2006, and has also taken many other measures and policy initiatives. Climate change is the net result of several factors and many sectors of the economy are climate sensitive. Therefore, it is essential to have assessments of impacts of climate change to various sectors of the economy directly or indirectly to enable devising the adaptation and mitigation strategies to respond to the changes immediately. Efforts to be address climate change adaptation and mitigation needs should not take resources away from the core development needs and growth objectives of the developing countries. The present paper is an attempt in this regard.

Keywords: climate change, human development, mitigation, adaptation, MDG

1. Introduction

Climate change is a global environmental problem which has been receiving intense political attention both at domestic and international levels. The United Nations Framework Convention on Climate Change (UNFCCC) defines 'climate change' as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The major characteristics of climate change include rise in average global temperature, ice cap melting, changes in precipitation, and increase in ocean temperature leading to sea level rise. The efforts needed to address the climate change problem include mitigation of GHG emissions on one hand, and building of adaptive capacities on the other in developing countries to cope with the adverse impacts of climate change on various sectors of the society and economy enabled and supported by technology and finance. Important negotiations and conventions related to climate changes are given in Table.1

Table.1

Conventions and negotiations on Climate change

The first World Climate Conference (WCC)	1979
The Intergovernmental Panel on Climate Change is set up	1988
IPCC's first assessment report released. IPCC and second World Climate Conference call for a global treaty on climate change. United Nations General Assembly negotiations on a framework convention begin.	1990
First meeting of the Intergovernmental Negotiating Committee (INC) takes place.	1991
The INC adopts UNFCCC text. At the Earth Summit in Rio, the UNFCCC is opened for signature along with its sister Rio Conventions, UNCBD and UNCCD.	1992
UNFCCC enters into force.	1994
The first Conference of the Parties (COP 1) takes place in Berlin	1995
The UNFCCC Secretariat is set up to support action under the Convention	1996
Kyoto Protocol formally adopted in December at COP3	1997
Release of IPCC's Third Assessment Report.	2001
Entry into force of the Kyoto Protocol. The first Meeting of the Parties to the Kyoto Protocol (MOP 1) takes place in Montreal.	2005
IPCC's Fourth Assessment Report released. Climate science entered into popular consciousness.	2007
Copenhagen Accord drafted at COP15 in Copenhagen. This was taken note of by the COP. Countries later submitted emissions reductions pledges or mitigation action pledges, all non-binding.	2009
Cancun Agreements drafted and largely accepted by the COP, at COP16	2010
The Durban Platform for Enhanced Action drafted and accepted by the COP, at COP17	2011

Climate change may pose a threat to food security through erratic rainfall patterns and decreasing crop yields, contributing to increased hunger and malnutrition in India.

Furthermore, adverse climate change impacts on natural systems and resources, infrastructure, and labour productivity may lead to reduced economic growth and increasing poverty. These effects threaten the achievement of MDG 1. Loss of livelihood assets, displacement and migration may lead to reduced access to education opportunities, thus hampering the realization of MDG 2. Depletion of natural resources and decreasing agricultural productivity may place additional burdens on women's health and reduce time for decision-making processes and income-generating activities, worsening gender equality and women's' empowerment (MDG 3). Increased incidence of vector-borne diseases, increases in heat-related mortality, and declining quantity and quality of drinking water will lead to adverse health effects threatening the achievement of MDGs 4, 5, 6 and 7. In general terms, the realization of MDG 7 may be approached through climate change negatively impacting quality and productivity of natural resources and ecosystems, possibly irreversibly, threatening environmental sustainability. Climate change, a global phenomenon, calls for a collective response in the form of global partnerships (MDG 8). Table 2 reveals that how millennium development goals linkages to climate change.

Table 2
Climate change and the Millennium development goals

Millennium Development Goal	**Linkage to Climate change**
Goal 1: Eradicate extreme poverty and hunger	• Climate change is projected to reduce poor people's livelihood assets, for example, health, access to water, homes and infrastructure. • Climate change is expected to alter the path and rate of economic growth due to changes in natural systems and resources, infrastructure and labour productivity. • A reduction in economic growth directly impacts poverty through reduced income opportunities. • In India food security is expected to worsen.
Goal 2: Achieve universal primary education	• Links to climate change are less direct, but loss of livelihood assets (social, natural, physical, human and financial capital) may reduce opportunities for full-time education in numerous ways. Natural disasters reduce children's available time, while displacement and migration can reduce access to education.
Goal 3: Promote gender equality and empower women	• Climate change is expected to exacerbate current gender inequalities. Depletion of natural resources and decreasing agricultural productivity may place additional burdens on women and girls' health and reduce time available to participate in decision-making processes and income generating activities. • Climate-related disasters have been found to impact more severely on female-headed households.
Goal 4:	• Direct effects of climate change include increases in heat

Reduce child mortality	related mortality and illness associated with heat waves. • Climate change will likely result in declining quantity and quality of drinking water, which is a prerequisite for good health, and exacerbate undernutrition – by reducing natural resource productivity and threatening food security.
Goal 5: Improve maternal health	Children and pregnant women are particularly susceptible to vector- and waterborne diseases.
Goal 6: Combat HIV/AIDS, malaria and other diseases	• Climate change may increase the prevalence of some vector-borne diseases and vulnerability to water or food-borne diseases, or diseases transmitted from person-to-person.
Goal 7: Ensure environmental sustainability	• Climate change will alter the quality and productivity of natural resources and ecosystems, some of which may be irreversibly damaged, and these changes may also decrease biological diversity and compound existing environmental degradation.
Goal 8: Develop a global partnership for development	• Climate change is a global issue and the response requires cooperation from all countries, especially to help developing countries adapt to the adverse impacts of climate change.

Source: Adapted and expanded from UNDP, UNEP, World Bank, Asian Development Bank (ADB).

2. Theoretical framework

The relationship between development and the environment is critical. The most widely used economic models of climate change are integrated assessment models linking climate and economic simulations (Nordhaus and Yang, 1996; Stern, 2007). The important assumptions underlying the economic models of climate change are rational actors, perfect competition and optimizing behaviour. The debate concerning the Stern review has uncovered the fact that the differences among the major climate change models are driven almost solely by assumptions about the rate of discounting the benefits of climate change mitigation (avoiding the costs of future climate damage to economic activity) and costs of mitigation efforts. In the case of climate change, we are dealing with pure uncertainty in terms of the potential risks, the prospects for future economic growth and proper social discount rate (Weitzman, 2007). As a result of the debate about the economic modelling in the Stern report there is a growing consensus among economists that the standard economic model is of limited use in dealing with either mitigation or adaptation policy responses to climate change. Adapting to climate change is increasingly challenging and will become more and more difficult as global temperatures rise. The task will be made easier because of new directions in economic theory and policy recommendations recognizing the heterogeneity of regional economies and of human communities. Two new directions in economics are relevant to this task.

The economics of well-being is a standard model of climate change and economic development. In this model per capita GDP is an indicator of social welfare. Frey and Stutzer point out that utility is equivalent to income and that more income makes a person happier. These measures show that the relationship between per capita income growth and well-being is not generally positive in real-world contexts, at least above some minimal income level (Frey and Stutzer 2002). They have shown that economic growth may reduce welfare even within a standard optimization model. Sen and Haq (1990) have developed a more complete measure of human well-being, called the 'Human Development Index' (HDI). It measures the average achievements in three basic dimensions of human development, health, education and income. After the formation of HDI, a number of related indices were developed in the purview of the human development. Most of the human well-being's indices show India's current position at the bottom. This measure clearly shows that economic growth by itself does not increase human development for the poor.

The study is mainly based on secondary data. The various sources include human development reports, UNDP reports, ADB reports, published and unpublished documents including journals, books, occasional publications, working papers, popular magazine and annual publications of social development organizations.

3. Context of the Climate Policy of India

The poor are the most vulnerable to climate change. Therefore, poverty eradication and improving standards of living will also reduce climate related vulnerability. The adverse impacts of climate change are causing severe droughts, floods; risks to human health, food security, lives and livelihood in the economy. At the national level, there has been a paradigm shift from the erstwhile relief centric and post-event syndrome to a pro-active prevention, mitigation and preparedness driven environmental and disaster management. Current government expenditure on adaptation to climate variability exceeds 2.6% of the GDP. India is committed to the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which represent the international consensus on the way to deal with climate change. India believes that uncompensated climate change mitigation by developing countries may hamper the speed of their economic growth. India has a very comprehensive framework of legal and institutional mechanisms in the region to respond to the tremendous challenges to the environment it is facing, owing to population growth, poverty and illiteracy augmented by urbanization and industrial development. India has initiated several climate-friendly measures, particularly in the area of renewable energy. India had adopted the

National Environment Policy 2006, and has also taken many other measures and policy initiatives.

India has, for many years, large nationally funded programs for reducing the adverse impacts due to the natural climate variability. These programs need to be extended and enhanced to cover the additional risks of climate change, through provision of financial resources and relevant technologies. Currently, several social sector and development schemes that emphasize on livelihood security, welfare of the weaker sections, and rural infrastructure are under implementation. Current Government expenditure in India on adaptation to climate variability exceeds 2.6 per cent of the GDP, with agriculture, water resources, health and sanitation, forests, coastal-zone infrastructure and extreme events, being specific areas of concern. As a part of its international obligations under the UNFCCC, India prepares periodically the National Communication (NATCOM) that gives an inventory of the greenhouse gases (GHG) emissions in India, and assesses the vulnerability and impacts and makes appropriate recommendations regarding social, economic and technological measures for addressing climate change and first NATCOM was presented in 2004. The Government of India had also set up an expert committee to study the impact of climate change on various sectors on May 7, 2007. The committee has studied the impact of anthropogenic climate change on India and has come out with its first set of findings and the research agenda that the ministries need to follow and implement in order to address India's vulnerability to anthropogenic climate change impacts.

4. Adaptation and Mitigation strategies of Climate change

There are two options available to address the problems which may arise out of climate change vulnerability. Both mitigation and adaptation are needed to significantly reduce the risks and increase the resilience of the world's most vulnerable citizens. In the near term, adaptation actions can reduce the impacts of climate change (although they cannot be reduced to zero). In the longer term, a failure to mitigate climate change will lead to such massive impacts that adaptations will be unsuccessful. Mitigation means taking action to reduce greenhouse gas emissions to avoid further climate change than has already occurred due to historic and current emissions. It is about transforming the way that individuals, governments and industry produce and use energy, changing activities to reduce or eliminate emissions, and developing clean and efficient infrastructure where it does not currently exist. Adaptation and mitigation should not be considered as either/or strategies, but rather as complementary ones that should be pursued together.

Some of the major schemes/policies significantly addressing adaptation objectives are as follows:

- Mahatma Gandhi Swarnajayanti Gram Swarozgar Yojana (Rural self-employment program)
- Sampoorna Grameen Rozgar Yojana (Comprehensive rural employment scheme)
- Pradhan Mantri Gram Sadak Yojana (Prime Minister's rural roads program)
- National Rural Health Mission
- Accelerated Rural Water Supply Programme
- Desert Development Programme
- Major and Medium Irrigation
- Sustainability of Dryland/Rainfed Farming System and
- Disaster Management

The outcomes of all these initiatives are that there has been effective delinking of energy sector growth from economic growth. Government of India has set up an 'Expert Committee on Impacts of Climate Change' to identify the measures that India may have to take in the future in relation to addressing vulnerability to anthropogenic climate change impacts. 'The National Action Plan on Climate change' has been prepared under the guidance and direction of Prime Minister's Council on Climate Change. The National Action Plan reflects the importance the Government attaches to mobilizing India's national energies to meet the challenge of climate change. The National Action Plan focuses attention on 8 priority National Missions.

i. Jawaharlal Nehru National Solar Mission (JNNSM)

The government has launched the JNNSM in January 2010 with a target of 20,000 MW grid solar power (based on solar thermal power- generating systems and solar photovoltaic [SPV] technologies), 2000 MW of off-grid capacity by 2022. The Mission will be implemented in three phases. The first phase will last three years (up to March 2013), the second till March 2017, and the third till March 2022.

ii. Energy Conservation and Efficiency

The objective of the National Mission for Enhanced Energy Efficiency (NMEEE) is to achieve growth with ecological sustainability by devising cost-effective strategies for end-

use demand-side management. The Ministry of Power and Bureau of Energy Efficiency have been entrusted with the task of preparing the implementation plan for the NMEEE and upscaling the efforts to create and sustain market for energy efficiency to unlock investment of around Rs 74,000 crore.

iii. National Mission on Strategic Knowledge for Climate Change (NMSKCC)

The NMSKCC has been launched with the broad objectives of mapping of the knowledge and data resources relevant to climate change and positioning of a data-sharing policy framework for building strategic knowledge among the various arms of the Government, identification of knowledge gaps, networking of knowledge institutions after investing critical mass of physical, intellectual, and policy infrastructure resources, creation of new dedicated centres within the existing institutional framework, building of international cooperation on science and technology for climate change agenda through strategic alliances and assistance for the formulation of policies for a sustained developmental agenda.

iv. National Mission for Sustaining Himalayan Ecosystem (NMSHE)

The broad objectives of the NMSHE include: understanding the complex processes affecting the Himalayan ecosystem and evolving suitable management and policy measures for sustaining and safeguarding it, creating and building capacities in different domains, networking of knowledge institutions engaged in research and development of a coherent data base on the Himalayan ecosystem, detecting and decoupling natural and anthropogenic-induced signals of global environmental changes in mountain ecosystems, studying traditional knowledge systems for community participation in adaptation, mitigation, and coping mechanisms inclusive of farming and traditional health care systems, and developing regional cooperation with neighbouring countries, to generate a strong data base through monitoring and analysis so as to eventually create a knowledge base for policy interventions.

v. National Water Mission

The objectives of the National Water Mission are 'conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources management'. The goals of the Mission are a comprehensive water data base in the public domain, assessment of the impact of climate change on water resources, promotion of citizen and State actions for water conservation, augmentation and preservation,

focused attention to overexploited areas, increasing water use efficiency by 20 per cent, and promotion of basin-level integrated water resources management.

vi. Green India Mission

The Mission aims at responding to climate change through a combination of adaptation and mitigation measures. These measures include enhancing carbon sinks in sustainably managed forests and other ecosystems, adaption of vulnerable species/ecosystems to the changing climate, and adaptation of forest-dependent communities. The objectives of the Mission are increased forest/tree cover on 5 million ha of forest/non-forest lands and improved quality of forest cover on another 5 million ha (a total of 10 million ha), improved ecosystem services including biodiversity, hydrological services, carbon sequestration as a result of treatment of 10 million ha), increased forest-based livelihood income for about 3 million households living in and around the forest, and enhanced annual CO2 sequestration by 55 million tonnes in the year 2020.

vii. National Mission on Sustainable Habitat (NMSH)

The NMSH seeks to promote sustainability of habitats through improvements in energy efficiency in building and urban planning, improved management of solid and liquid waste including recycling and power generation, modal shift towards public transport, and conservation. It also seeks to improve ability of habitats to adapt to climate change by improving resilience of infrastructure, community- based disaster management, and measures for improving advance warning systems for extreme weather events.

viii. National Mission for Sustainable Agriculture

The National Mission for Sustainable Agriculture (NMSA) seeks to address issues regarding 'sustainable agriculture' in the context of risks associated with climate change by devising appropriate adaptation and mitigation strategies for ensuring food security, enhancing livelihood opportunities, and contributing to economic stability at national level. Under this Mission, the adaptation and mitigation measures would be mainstreamed in research and development activities, absorption of improved technology and best practices, creation of physical and financial infrastructure and institutional framework, facilitating access to information and promoting capacity building.

Eight key interventions may be identified that will contribute to reductions in human vulnerability among the people.

1. **Household water supply, sanitation and hygiene-** including water treatment, oral rehydration therapy, hygiene education and sanitation.
2. **Groundwater recharge and watershed remediation-** including rainwater harvesting, run-off catchments, watershed clean-ups, tree planting and restoration of biodiversity.
3. **Disaster risk reduction and preparedness-** including risk mapping and evacuation plans.
4. **Environmental protection and restoration-** such as school and community gardens, tree planting and clean-up of stagnant water and solid waste.
5. **Renewable energy solutions-** including clean energy for homes, communities, solar and wind water pumps and clean and efficient household solutions for cooking and heating.
6. **Health-related interventions-** including improvements to basic public health infrastructure, environmental health surveillance, insecticide-treated mosquito nets and malaria prophylaxis and treatment.
7. **Community capacity-building-** including environmental education, micro enterprise for women, education for sustainable development, participatory local actions and vocational training/job creation.
8. **Social protection and psychosocial support-** including life skills and conflict resolution, education and other programmes to support livelihoods and community functioning, 'safety net' interventions to help prevent dislocation and exploitation of children, and interventions to address family and individual stress and trauma.

5. Concluding remarks

The impact of vulnerability is not only decided by the extent of climate change, but also by the robustness of the developmental process in the economy. Global climate change has emerged as a threat to sustainability and seriously endangers the Indian economy. India has initiated its efforts for adaptation and mitigation through comprehensive Climate Policy in the right direction. However various measures have been undertaken which have direct relevance of for these issues, for instance the promotion of renewable energy programme and aforestation activities. The encouragement of new and renewable sources of energy has direct implication for the problem of climate change. India's stand as a developing country is that

GHG abatement in any form involves significant economic costs and will adversely impact GDP growth as it requires a shift from cheap fossil fuels to costlier non-carbon energy. Efforts to address climate change adaptation and mitigation needs should not take resources away from the core development needs and growth objectives of the developing countries.

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